

WHAT IS CLAIMED IS:

1. A needle-less injector for a liquid, which is in the form of a hand-held unit, comprising a housing and a supply container for the liquid, wherein:

the housing includes two portions (1, 2), (31, 32) which are connected together and which are arranged rotatably relative to each other, and  
the needle-less injector includes a locking stressing mechanism with a sprung portion (3, 33, 53) which is displaceable between two abutments (17, 47) and which is provided with a triggering device, and a hollow plunger (7, 37, 57) which is fixed in the sprung portion (3, 33, 53) and which is driven by the locking stressing mechanism, wherein the hollow plunger is arranged slidably within a cylinder (8, 38) and includes a single valve body (12, 42) and disposed at the end of the cylinder is a nozzle (9, 39) having at least one opening (10, 40) and the space between the nozzle and the valve body forms a pump chamber (13, 43), and

the supply container (14, 44, 54) for the liquid is arranged within the housing and is in the form of a container separate from the needle-less injector and is connected by means of a press fit (19, 49, 59) to the end of the hollow plunger, which projects out of the cylinder, and

the amount of liquid which when the hollow plunger (7) is pulled out of the cylinder (8) has been conveyed through the hollow plunger into the pump chamber (43) is determined by the stroke travel (a) and the cross-section of the hollow plunger, and

the position of the hollow plunger stroke travel (a) within the needle-less injector is determined by the position of the two abutments (17, 47).

2. A needle-less injector according to claim 1 wherein:

the two portions (1, 2), (31, 32) of the housing are releasably connected together.

3. A needle-less injector according to claims 1 and 2 wherein:  
the nozzle (9, 39) includes only one opening (10, 40) of a hydraulic diameter of from 10  $\mu\text{m}$  to 500  $\mu\text{m}$ , preferably from 50  $\mu\text{m}$  to 150  $\mu\text{m}$ , and  
the nozzle opening (10, 40) is of a length of from 50  $\mu\text{m}$  to 500  $\mu\text{m}$ , preferably from 100  $\mu\text{m}$  to 300  $\mu\text{m}$ .
4. A needle-less injector according to claims 1 to 3 wherein:  
the nozzle (9, 39) includes a plurality of nozzle openings whose hydraulic diameter is possibly different.
5. A needle-less injector according to claims 1 to 4 wherein:  
the nozzle (9, 39) includes a plurality of nozzle openings whose longitudinal axes extend in mutually parallel relationship or are inclined divergently relative to each other.
6. A needle-less injector according to claims 1 to 5 wherein:  
the position of an abutment and therewith the hollow piston stroke travel (a) is variable.
7. A needle-less injector according to claims 1 to 6 wherein:  
the locking stressing mechanism can be stressed by rotating the two housing portions (1, 2), (31, 32) relative to each other by hand.
8. A needle-less injector according to claims 1 to 7 wherein:  
the locking stressing mechanism can be stressed by way of a worm-thrust transmission arrangement by rotation of the two housing portions (1, 2), (31, 32) relative to each other.

9. A needle-less injector according to claims 1 to 8 wherein:  
the locking stressing mechanism includes a coil spring (6, 36),  
a disk spring or a leaf spring as the energy storage means.

10. A needle-less injector according to claims 1 to 9 wherein:  
the nozzle (9, 39) comprises metal, plastics material, glass,  
silicon or precious stone such as sapphire, ruby or corundum.

11. A needle-less injector according to claims 1 to 10 wherein:  
the separate supply container (14, 44, 54) for the liquid is in the  
form of a replaceable supply container and the sprung portion (53) is adapted  
to receive the separate supply container.

12. A needle-less injector according to claims 1 to 11 wherein:  
the separate supply container (14, 44, 54) for the liquid is  
releasably connected to the hollow plunger (7, 37, 57) and is displaceable with  
the stroke movement of the hollow plunger within the housing.

13. A needle-less injector according to claims 1 to 12 wherein:  
the separate supply container (54) for the liquid is releasably  
connected to the hollow plunger (57) and the sprung portion (53), and  
the sprung portion (53) is provided with snap hooks (51) which  
engage into a peripherally extending groove (52) in the supply container.

14. A needle-less injector according to claims 1 to 13 wherein:  
the nozzle end of the needle-less injector is provided with a  
closure cap (18).

15. A needle-less injector according to claims 1 to 14 wherein:  
a filter (11) is disposed in front of the side of the nozzle, which  
is towards the pump chamber.

16. A needle-less injector according to claims 1 to 15 wherein:  
the separate supply container (14, 44, 54) for the liquid is filled with a liquid medicament, preferably from the group of analgesics, vaccines, anti-diabetic agents, hormones, contraceptives, vitamins, antibiotics, sedatives, antimicrobial substances, amino acids and coronary agents.

17. A needle-less injector according to claims 1 to 16 for a liquid, which is in the form of a hand-held unit, comprising a housing and a supply container for the liquid, wherein:

the housing includes two portions (1, 2), (31, 32) which are releasably connected together and which are arranged rotatably relative to each other, and

the needle-less injector includes a locking stressing mechanism with a sprung portion (3, 33, 53) displaceable between two abutments (17, 47) and a coil spring (6, 36), and the locking stressing mechanism can be stressed by way of a worm-thrust transmission arrangement by rotation of the two housing portions (1, 2), (31, 32) relative to each other, and the locking stressing mechanism is provided with a triggering device, and

the needle-less injector includes a hollow plunger (7, 37, 57) which is fixed in the sprung portion (3, 33, 53) and which is driven by the locking stressing mechanism, wherein the hollow plunger is arranged displaceably within a cylinder (8, 38) and includes a single valve body (12, 42), and

disposed at the end of the cylinder is a nozzle (9, 39) with a single opening (10, 40) and the space between the nozzle and the valve body forms a pump chamber (13, 43), and

the supply container (14, 44, 54) for the liquid is arranged within the housing and is in the form of a supply container which is separate from the needle-less injector and which is connected by means of a press fit (59) to the end of the hollow plunger projecting out of the cylinder, and which

is connected to the sprung portion (53) by means of snap hooks (51) which engage into a peripherally extending groove (52) in the supply container, and the position of the hollow plunger stroke travel (a) within the needle-less injector is determined by the position of the two abutments (17, 47), and

the separate supply container (14, 44, 54) is filled with a liquid drug.

18. Use of the needle-less injector according to claims 1 to 17 for the injection of an active substance-bearing liquid into biological tissue.

19. Use of the needle-less injector according to claims 1 to 17 for the injection of an active substance-bearing liquid into vegetable tissue.

20. Use of the needle-less injector according to claims 1 to 17 for the injection of an active substance-bearing liquid into animal tissue.

21. Use of the needle-less injector according to claims 1 to 17 for the intracutaneous injection of vaccines into an animal.

22. Use of the needle-less injector according to claims 1 to 17 for the subcutaneous injection of vaccines into an animal.

23. Use of the needle-less injector according to claims 1 to 17 for the intracutaneous injection of vaccines into a human being.

24. Use of the needle-less injector according to claims 1 to 17 for the subcutaneous injection of vaccines into a human being.

25. Use of a needle-less injector according to claims 1 to 17 for the injection of a liquid through a membrane into the space behind the membrane.

26. A method of injecting a liquid into tissue comprising the steps of:

(a) providing a hand-held, needle-less injector, the needle-less injector including,

a housing including at least two portions rotatable relative to each other,

a cylinder disposed within said housing,

a locking stressing mechanism disposed within said housing, said locking stressing mechanism including,

a sprung portion, and

a hollow plunger having a first end and a second end, said hollow plunger being fixed to said sprung portion, wherein said hollow plunger slidably extends within said cylinder, and wherein said hollow plunger includes a valve body disposed at said first end of said hollow plunger,

a nozzle having at least one opening, said nozzle being fixed to said cylinder such that said nozzle, said cylinder and said valve body form a pump chamber therebetween, and

a removable supply container disposed within said housing, said supply container being connected around said second end of said hollow plunger, wherein an amount of a liquid conveyed from said supply container, through said hollow plunger into said pump chamber is determined by a stroke travel distance and a cross-section of said hollow plunger;

(b) pressing the needle-less injector against the tissue at an injection location; and

(c) activating the needle-less injector such that the liquid is injected at a force sufficient to penetrate the tissue.

27. The method according to claim 26, wherein said two portions of said housing of said needle-less injector are releasably connected together.

28. The method according to claim 26, wherein said nozzle of said needle-less injector includes one opening having a hydraulic diameter in the range of 10 Fm to 500 Fm and said one opening has a length in the range of 50 Fm to 500 Fm.

29. The method according to claim 26 wherein said nozzle includes one opening having a hydraulic diameter in the range of 50 Fm to 150 Fm and said one opening is of a length in the range of 100 Fm to 300 Fm.

30. The method according to claim 26, wherein said nozzle of said needle-less injector includes a plurality of nozzle openings.

31. The method according to claim 30, wherein said plurality of nozzle openings have longitudinal axes extending in mutually parallel relationship or inclined divergently relative to each other.

32. The method according to claim 26, wherein said housing of said needle-less injector includes an adjustable abutment extending therefrom for determining said stroke travel distance, such that said stroke travel distance of said hollow plunger is varied by said adjustable abutment.

33. The method according to claim 26, wherein said locking stressing mechanism of said needle-less injector is stressed by rotating the two housing portions relative to each other by hand.

34. The method according to claim 33, wherein said locking stressing mechanism is stressed by rotation of the two housing portions relative to each other to acuate a worm-thrust transmission.

35. The method according to claim 26, wherein said locking stressing mechanism of said needle-less injector further comprises an energy

storage means selected from the group of a coil spring, a disk spring and a leaf spring.

36. The method according to claim 26, wherein said nozzle of said needle-less injector is comprised of metal, plastics material, glass, silicon or precious stone such as sapphire, ruby or corundum.

37. The method according to claim 26, wherein said removable supply container of said needle-less injector is a replaceable supply container and said sprung portion receives said removable supply container.

38. The method according to claim 26, wherein said removable supply container of said needle-less injector is releasably connected around said second end of said hollow plunger and is displaceable with the stroke movement of the hollow plunger within the housing.

39. The method according to claim 38, wherein said removable supply container includes a peripheral groove and wherein said sprung portion is provided with snap hooks which releasably engage into said peripheral groove of said removable supply container.

40. The method according to claim 26, wherein said needle-less injector further comprises a removable closure cap around said nozzle.

41. The method according to claim 26, wherein said needle-less injector further comprises a filter disposed adjacent said nozzle in said pump chamber.

42. The method according to claim 26, wherein said removable supply container of said needle-less injector contains a liquid medicament.



43. The method according to claim 42 wherein said liquid medicament is selected from the group consisting of analgesics, vaccines, anti-diabetic agents, hormones, contraceptives, vitamins, antibiotics, sedatives, antimicrobial substances, amino acids and coronary agents.

44. The method according to claim 26 wherein said sprung portion of said needle-less injector is displaceable between two abutments.

45. The method according to claim 26 wherein said sprung portion of said needle-less injector is provided with a triggering device, and wherein said step of activating said needle-less injector comprises pressing the triggering device.

46. The method according to claim 26 wherein said sprung portion of said needle-less injector is driven by said locking stressing mechanism.

47. The method according to claim 26 wherein said supply container of said needle-less injector is connected around said second end of said hollow plunger by a press fit.

48. The method according to claim 26, wherein the tissue is biological tissue.

49. The method according to claim 26, wherein the tissue is vegetable tissue.

50. The method according to claim 26, wherein the tissue is animal tissue.

51. The method according to claim 26, wherein the liquid is vaccine and the liquid is injected intracutaneously into an animal.

52. The method according to claim 26, wherein the liquid is a vaccine and the liquid is injected subcutaneously into an animal.

53. The method according to claim 26, wherein the liquid is a vaccine and the liquid is injected intracutaneously into a human being.

54. The method according to claim 26, wherein the liquid is a vaccine and the liquid is injected subcutaneously into a human being.

55. The method according to claim 26, wherein the tissue is a membrane and the liquid is injected to a spaces behind the membrane.

56. A method of injecting a liquid into tissue comprising the steps of:

(a) providing a hand-held, needle-less injector, the needle-less injector including,

a housing including at least two portions releasably connected together and rotatable relative to each other,

a cylinder disposed within said housing,

a locking stressing mechanism disposed within said housing, said locking stressing mechanism, including,

a sprung portion having snap hooks extending therefrom;

a coil spring biasing said sprung portion, and

a hollow plunger having a first end and a second end, said hollow plunger being fixed to said sprung portion, wherein the hollow plunger displaceably extends within said cylinder, and wherein said hollow plunger includes a valve body disposed at said first end of said hollow plunger,

a nozzle having a single opening, said nozzle being fixed to said cylinder such that said nozzle, said cylinder and said valve body form a pump chamber therebetween,

a removable supply container disposed within said housing, said removable supply container being connected around said second end of said hollow plunger, and wherein said removable supply container includes a peripheral groove which engages said snap hooks of said sprung portion, wherein a liquid drug disposed in said removable supply container;

(b) pressing the needle-less injector against the tissue at an injection location; and

(c) activating the needle-less injector such that the liquid is injected at a force sufficient to penetrate the tissue.

57. The method according to claim 56 wherein said removable supply container is connected around said second end of said hollow plunger by means of a press fit.

58. The method according to claim 56, wherein the liquid is an active substance-bearing liquid and the tissue is a biological tissue.

59. The method according to claim 56 wherein the liquid is an active substance-bearing liquid and the tissue is a vegetable tissue.

60. The method according to claim 56 wherein the liquid is an active substance-bearing liquid and the tissue is an animal tissue.

61. The method according to claim 56 wherein the liquid is a vaccine and the liquid is injected intracutaneously into an animal.

62. The method according to claim 56 for the subcutaneous injection of vaccines into an animal.

63. The method according to claim 56 wherein the liquid is a vaccine and the liquid is injected intracutaneously into a human being.

64. The method according to claim 56 wherein the liquid is a vaccine and the liquid is injected subcutaneously into a human being.

65. The method according to claim 56 wherein the tissue is a membrane and the liquid is injected into a space behind the membrane.